

TABLE 3

Zone	Pressure kPa g (psig)	Temp. (C.)	LHSV (h ⁻¹)	H ₂ /oil (scf/bbl)	Oil yield (vol %)	Effluent Properties		
						O (wt %)	H ₂ O	TAN (mg KOH/g oil)
1. Upper Zone of Reactor (Partial Deoxygenation)	13,445 (1950)	250	0.14	10500	0.25	0.0035	300 ppm	1.6
2: Bottom Zone of Reactor (Full Deoxygenation)		400						

Table 4 shows the typical distribution of hydrocarbon classes produced after full deoxygenation of whole pyrolysis oil. The final distribution depends on the feedstock processed, catalyst choice, and process conditions. The distribution of the final product from example 2 above is shown in the "Example 2 Product" column of Table 4. This represents a hydrocarbon product produced from solid corn stover pyrolysis oil processed as described in Table 2.

TABLE 4

Hydrocarbon class	Min (wt %)	Max (wt %)	Example 2 Product
n-paraffins	5	10	8.3
isoparaffins	15	25	15.5
olefins	0.1	1	0.2
naphthene	35	55	52.4
aromatic	10	35	23.5
oxygenate	0.1	0.8	0.1

The boiling point distribution of several fully deoxygenated pyrolysis oils is shown in FIG. 4. As shown the hydrocarbon product produced has a wide boiling point range with significant fractions in the range for each fuel. Some heavier components are also present that fall outside the range of gasoline, aviation fuel, and diesel. These heavy components could be recycled back into the second zone for further hydrocracking or be isolated for other industrial uses.

The invention claimed is:

1. A process for producing hydrocarbon products from whole pyrolysis oil feedstock comprising:

- (a) partially deoxygenating the whole pyrolysis oil feedstock in a partial deoxygenation zone by contacting the pyrolysis oil with a partial deoxygenation and hydrogenation catalyst in the presence of hydrogen at deoxygenation conditions to produce a partially deoxygenated pyrolysis oil stream comprising water, gasses, light ends, and hydrocarbons;
- (b) passing the partially deoxygenated pyrolysis oil stream to a separation zone to separate a water, gasses, and light ends stream from a remainder stream wherein the light ends of the water, gasses, and light ends stream are processed other than blending with the product stream of step (c); and
- (c) passing the remainder stream to a full deoxygenation zone and deoxygenating the remainder stream by contacting with a deoxygenation catalyst under deoxygenation conditions, to generate a product stream comprising hydrocarbon compounds useful as a fuel or a fuel blending component in the boiling point ranges of gasoline, aviation, diesel, and any combination thereof wherein the product stream comprises from about 1 to

about 14 wt % hydrocarbon compounds having a boiling point of about 400° C. to about 600° C.

2. The process of claim 1 further comprising passing the product stream to a second separation zone to separate water, gasses, and light ends from the product stream and generate a purified product stream wherein the light ends of the water, gasses, and light ends stream are processed other than blending with the product stream of claim 1 step (c), and passing the purified product stream to a product fractionation zone to separate the hydrocarbon compounds in the boiling point range of gasoline and the hydrocarbons in the boiling point range of diesel fuel.

3. The process of claim 2 further comprising separating, in the product fractionation zone, the hydrocarbons in the boiling point range of aviation fuel.

4. The process of claim 3 further comprising recycling a portion of the hydrocarbon compounds in the boiling point range of gasoline, the hydrocarbon compounds in the boiling point range of aviation fuel, the hydrocarbons in the boiling point range of diesel fuel, or any combination thereof, to the partial deoxygenation zone, the full deoxygenation zone, or both wherein the volume ratio of recycle to feed to the deoxygenation zone is in the range of about 2:1 to about 8:1.

5. The process of claim 2 further comprising passing the water, gasses, and light ends stream from the second separation zone to a reforming zone to generate a hydrogen stream, and passing the hydrogen stream to the partial deoxygenation zone, the full deoxygenation zone, or both.

6. The process of claim 2 further comprising passing the water, gasses, and light ends stream from the separation zone and the passing the water, gasses, and light ends stream from the second separation zone to a reforming zone to generate a hydrogen stream, and passing the hydrogen stream to the partial deoxygenation zone, the full deoxygenation zone, or both.

7. The process of claim 1 further comprising recycling a portion of the product stream to the partial deoxygenation zone, the full deoxygenation zone, or both wherein the volume ratio of recycle to feed to the deoxygenation zone is in the range of about 2:1 to about 8:1.

8. The process of claim 1 wherein the catalyst in the full deoxygenation zone is more active than the catalyst in the partial deoxygenation zone, the deoxygenation conditions in the full deoxygenation zone are more severe than those of the partial deoxygenation zone, or both.

9. The process of claim 1 further comprising passing the water, gasses, and light ends stream from the separation zone to a reforming zone to generate a hydrogen stream.

10. The process of claim 9 further comprising passing the hydrogen stream to the partial deoxygenation zone, the full deoxygenation zone, or both.